

MOD-LCD4.3 development board **USER'S MANUAL**

Initial release, March 2012
Designed by OLIMEX Ltd, 2011



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**Thank you for purchasing MOD-LCD4.3 development board assembled by
OLIMEX LTD**

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CHAPTER 1

OVERVIEW

1. Introduction to the chapter

Thank you for choosing the MOD-LCD4.3 development board from Olimex! This document provides a User's Guide for the Olimex MOD-LCD4.3 development board. As an overview, this chapter gives the scope of this document and lists the board's features. The document's organization is then detailed.

The MOD-LCD4.3 development board enables code development of applications running on the LPC2478 microcontroller, manufactured by NXP.

The board is suitable as a touchscreen LCD extension to existing and future Olimex boards that have UEXT connector. Also due to the flexible flat cable connecting the display to the board, it is very easy for the LCD to be embedded in industrial panels.

1.1 Features

- MCU: LPC2478 512KB Flash, 98KB RAM, 72Mhz
- LCD 4.3" 480x272 pixels 24bit color TFT color with Backlight and Touchscreen
- micro SD card
- 32MB of SDRAM
- DC-DC for the LCD backlight
- UEXT connector to interface with any of our development boards with UEXT connector
- mini USB device connector
- optional 3-axis digital accelerometer with 11 bit accuracy
- USB device connector
- JTAG connector
- RESET button and circuit
- USER button
- power supply LED
- USB activity LED
- Touchscreen interface
- EXT1 and EXT2 2x20 pin 0.05" extension connectors on the board edge for all unused

LPC2478 ports

- FR-4, 1.5 mm, red soldermask, component print
- Dimensions: 115mm x 67.5mm (4.5" x 2.7")

1.2 Organization

Each section in this document covers a separate topic, organized as follow:

- Chapter 1 is an overview of the board usage and features
- Chapter 2 provides a guide for quickly setting up the board
- Chapter 3 contains the general board diagram and layout
- Chapter 4 describes the component that is the heart of the board: the LPC2478FBD208 microcontroller
- Chapter 5 is an explanation of the control circuitry associated with the microcontroller to reset. Also shows the clocks on the board
- Chapter 6 covers the connector pinout, peripherals and jumper description
- Chapter 7 shows the memory map
- Chapter 8 provides the schematics
- Chapter 9 contains the revision history

CHAPTER 2

SETTING UP THE MOD-LCD4.3 BOARD

2. Introduction to the chapter

This section helps you set up the MOD-LCD4.3 development board for the first time.

Please consider first the electrostatic warning to avoid damaging the board, then discover the hardware and software required to operate the board.

The procedure to power up the board is given, and a description of the default board behavior is detailed.

2.1 Electrostatic warning

MOD-LCD4.3 is shipped in a protective anti-static package. The board must not be exposed to high electrostatic potentials. A grounding strap or similar protective device should be worn when handling the board. Avoid touching the component pins or any other metallic element.

2.2 Requirements

In order to set up the MOD-LCD4.3, the following items are required:

- A source of power applied to at least one of the following:
 - mini USB – standard 5V
 - PWR JACK - 9-12Vdc or 6-9Vac
 - JTAG – 5V from the JTAG debugger
 - UEXT – 3.3V from external host device connected to the UEXT
 - EXT1/EXT2 – 5V applied directly
- A programmer that has 20 pin interface and supports programming of LPC2478

You may use any of Olimex's ARM-JTAG programmer/debugger (For example ARM-USB-TINY-H) for this task.

Also, a host-based software toolchain is required in order to program/debug the MOD-LCD4.3 board. There are also a number of ready IDEs available like IAR Embedded Workbench, Rowley CrossWorks, etc.

Olimex also maintains own distribution of GCC and Eclipse suitable for use with our programmers.

2.3 Powering the board

On powering the board the PWR LED, the SD LED and the display should turn on. After that the touchscreen should show a simple color palette and a mouse pointer that responses on dragging.

If measuring the current consumption it should be around 15 mA.

2.4 Prebuilt software

On arrival the board has a basic demo installed which features test of the LEDs, the color range and the touch response of the LCD, the SD card slot and the USB connectivity.

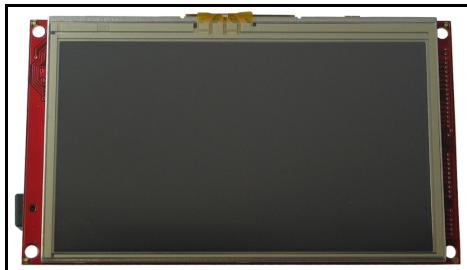
CHAPTER 3

MOD-LCD4.3 BOARD DESCRIPTION

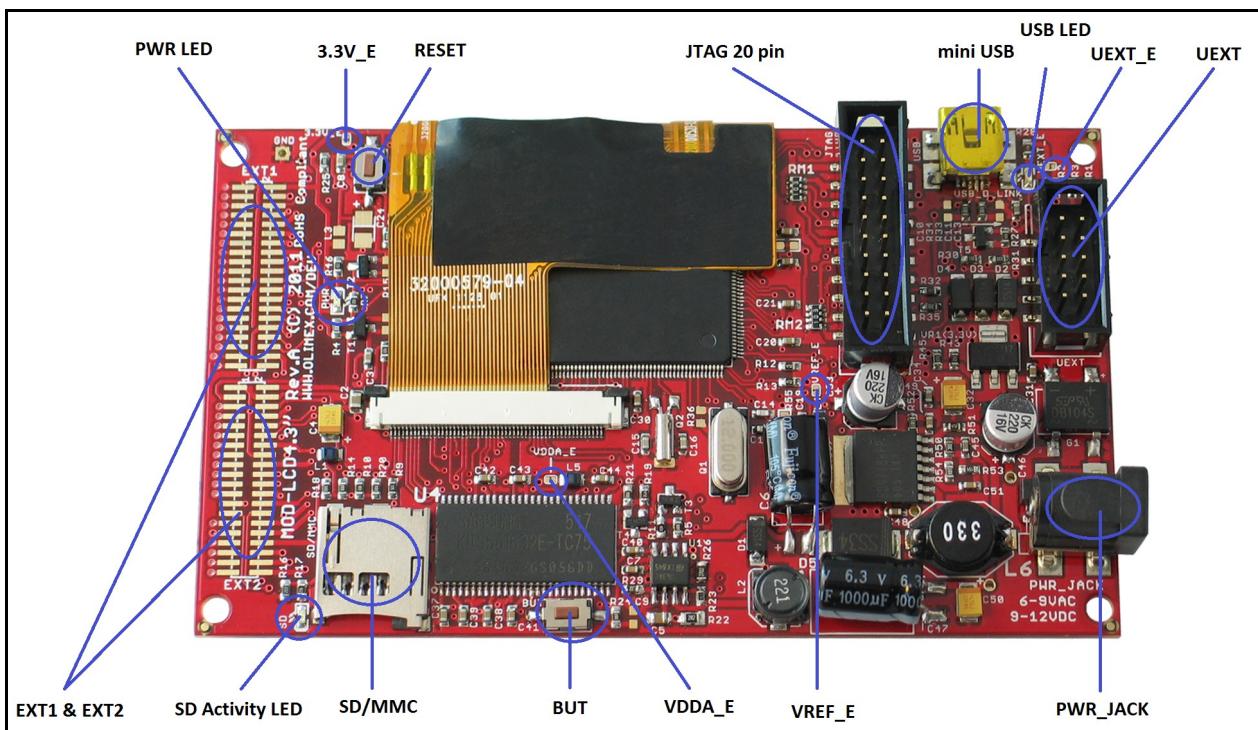
3. Introduction to the chapter

Here you get acquainted with the main parts of the board. Note the names used on the board differ from the names used to describe them. For the actual names check the MOD-LCD4.3 board itself.

3.1 Layout (top view)



3.2 Layout (bottom view)



CHAPTER 4

THE LPC2478FBD208 MICROCONTROLLER

4. Introduction to the chapter

In this chapter is located the information about the heart of MOD-LCD4.3 – its microcontroller. The information is a modified version of the datasheet provided by its manufacturers.

4.1 The microcontroller

- ARM7TDMI-S processor, running at up to 72 MHz.
- 512 kB on-chip flash program memory with In-System Programming (ISP) and In-Application Programming (IAP) capabilities. Flash program memory is on the ARM local bus for high performance CPU access.
- 98 kB on-chip SRAM includes:
 - 64 kB of SRAM on the ARM local bus for high performance CPU access.
 - 16 kB SRAM for Ethernet interface. Can also be used as general purpose SRAM.
 - 16 kB SRAM for general purpose DMA use also accessible by the USB.
 - 2 kB SRAM data storage powered from the RTC power domain.
- LCD controller, supporting both Super-Twisted Nematic (STN) and Thin-Film Transistors (TFT) displays.
 - Dedicated DMA controller.
 - Selectable display resolution (up to 1024 × 768 pixels).
 - Supports up to 24-bit true-color mode.
- Dual Advanced High-performance Bus (AHB) system allows simultaneous Ethernet DMA, USB DMA, and program execution from on-chip flash with no contention.
- EMC provides support for asynchronous static memory devices such as RAM, ROM and flash, as well as dynamic memories such as Single Data Rate SDRAM.
- Advanced Vectored Interrupt Controller (VIC), supporting up to 32 vectored interrupts.
- General Purpose AHB DMA controller (GPDMA) that can be used with and SD/MMC interface as well as for memory-to-memory transfers.
- Serial Interfaces:
 - Ethernet MAC with MII/RMII interface and associated DMA controller. These functions reside on an independent AHB.
 - USB 2.0 full-speed dual-port device/host/OTG controller with on-chip PHY and associated DMA controller.

- Four UARTs with fractional baud rate generation, one with modem control I/O, one with IrDA support, all with FIFO.
- CAN controller with two channels.
- SPI controller.
- Two SSP controllers, with FIFO and multi-protocol capabilities. One is an alternate for the SPI port, sharing its interrupt. SSPs can be used with the GPDMA controller.
- Three I2C-bus interfaces (one with open-drain and two with standard port pins).
- I2S (Inter-IC Sound) interface for digital audio input or output. It can be used with the GPDMA.
- Other peripherals:
 - SD/MMC memory card interface.
 - 160 General purpose I/O pins with configurable pull-up/down resistors.
 - 10-bit ADC with input multiplexing among 8 pins.
 - 10-bit DAC.
 - Four general purpose timers/counters with 8 capture inputs and 10 compare outputs. Each timer block has an external count input.
 - Two PWM/timer blocks with support for three-phase motor control. Each PWM has an external count inputs.
 - Real-Time Clock (RTC) with separate power domain. Clock source can be the RTC oscillator or the APB clock.
 - 2 kB SRAM powered from the RTC power pin, allowing data to be stored when the rest of the chip is powered off.
 - WatchDog Timer (WDT). The WDT can be clocked from the internal RC oscillator, the RTC oscillator, or the APB clock.
- Single 3.3 V power supply (3.0 V to 3.6 V).
- 4 MHz internal RC oscillator trimmed to 1 % accuracy that can optionally be used as the system clock.
- Three reduced power modes: idle, sleep, and power-down.
- Four external interrupt inputs configurable as edge/level sensitive. All pins on port 0 and port 2 can be used as edge sensitive interrupt sources.
- Processor wake-up from Power-down mode via any interrupt able to operate during Power-down mode (includes external interrupts, RTC interrupt, USB activity, Ethernet wake-up interrupt, CAN bus activity, port 0/2 pin interrupt).
- Two independent power needed features.
- Each peripheral has its own clock divider for further power saving. These dividers help reduce active power by 20 % to 30 %.
- Brownout detect with separate thresholds for interrupt and forced reset.
- On-chip power-on reset.
- On-chip crystal oscillator with an operating range of 1 MHz to 24 MHz.
- On-chip PLL allows CPU operation up to the maximum CPU rate without the need for a

high frequency crystal. May be run from the main oscillator, the internal RC oscillator, or the RTC oscillator.

- Boundary scan for simplified board testing.
- Versatile pin function selections allow more possibilities for using on-chip peripheral functions.
- Standard ARM test/debug interface for compatibility with existing tools.
- Emulation trace module supports real-time trace.

For comprehensive information on the microcontroller visit the NXP's web page for a datasheet.

At the moment of writing the microcontroller datasheet can be found at the following link:

http://www.nxp.com/documents/data_sheet/LPC2478.pdf

CHAPTER 5

CONTROL CIRCUITY

5. Introduction to the chapter

Here you can find information about reset circuit and quartz crystal locations.

5.1 Reset

MOD-LCD4.3 reset circuit includes R25 (33 K Ω), C8 (100 nF), LPC2478 pin 35 (NRST) and a RESET button. The RESET is also connected to the JTAG pin 15.

5.2 Clock

12 MHz quartz crystal Q1 is connected to pins 44 and 46 of the processor.

Real time clock (RTC) Q2 @ 32 768 Hz is found at pins 34 and 36 of the processor.

CHAPTER 6

HARDWARE

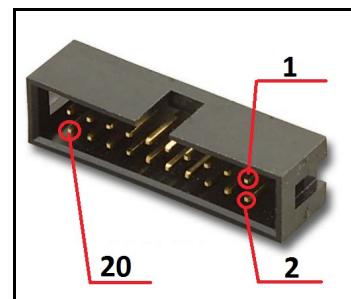
6. Introduction to the chapter

In this chapter are presented the connectors that can be found on the board all together with their pinout. Jumpers functions are described. Notes and info on specific peripherals are presented. Notes regarding the interfaces are given.

6.1 JTAG connector

The 20 pin JTAG connector provides the interface for JTAG programming/debugging.

JTAG interface			
Pin #	Signal Name	Pin #	Signal Name
1	+3.3V	11	+3.3 V
2	+3.3V	12	GND
3	TRST	13	TDO
4	GND	14	GND
5	TDI	15	RST
6	GND	16	GND
7	TMS	17	GND
8	GND	18	GND
9	TCK	19	+5V_JTAG
10	GND	20	GND



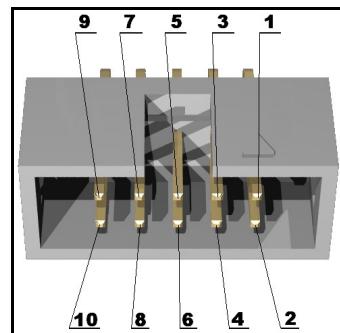
6.2 UEXT

MOD-LCD4.3 board has UEXT connector and can interface Olimex's UEXT boards adding display and SD card functionality. Of course the board can be used standalone.

For more information on UEXT please visit:

<http://www.olimex.com/dev/OTHER/UEXT.pdf>

Pin #	Signal Name
1	+3.3V
2	GND
3	TXD0
4	RXD0
5	SCL2
6	SDA2
7	MISO
8	MOSI
9	SCK
10	SSL

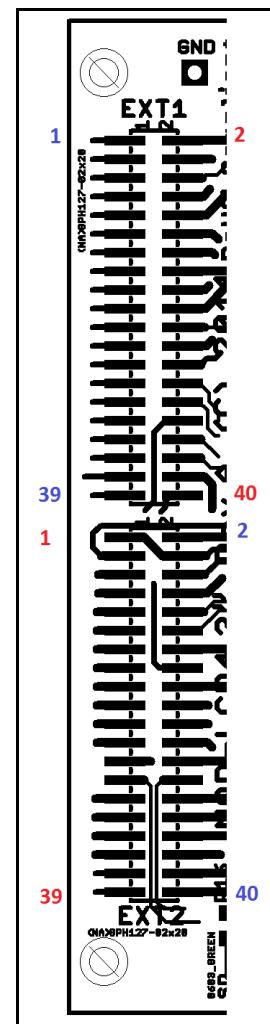


6.3 EXT1 pads

EXT1 and EXT2 lead the unused processor pins to neat pads positioned near the end of the bottom of the board. Note that there isn't connectors attached to them. Signals named Px[y] can be checked in the processor's datasheet for their corresponding functions.

EXT1			
Pin #	Pin signal	Pin #	Pin signal
1	GND	2	3.3V

3	+5V	4	Vin
5	GND	6	P2[3]
7	P2[5]	8	P2[11]
9	P2[14]	10	P2[15]
Pin #	Signal name	Pin #	Signal name
11	P2[19]	12	P2[21]
13	P2[22]	14	P2[23]
15	P2[25]	16	P2[26]
17	P2[27]	18	P2[30]
19	P2[31]	20	P3[16]
21	P3[17]	22	P3[18]
23	P3[19]	24	P3[20]
25	P3[21]	26	P3[22]
27	P3[23]	28	P3[24]
29	P3[25]	30	P3[26]
31	P3[27]	32	P3[28]
33	P3[29]	34	P3[30]
35	P3[31]	36	P4[15]
37	P4[16]	38	P4[17]
39	P4[18]	40	P4[19]



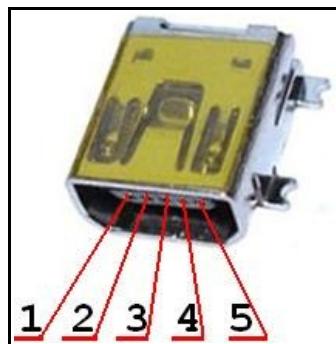
6.4 EXT2 pads

EXT2			
Pin #	Pin signal	Pin #	Pin signal
1	GND	2	3.3V
3	+5V	4	Vin
5	GND	6	P4[22]
7	P4[23]	8	P4[24]
9	P4[26]	10	P4[27]
11	P4[30]	12	P4[31]
13	ALARM	14	P1[31]

15	P1[30]	16	P1[17]
17	P1[16]	18	P1[15]
19	P1[14]	20	P1[13]
Pin #	Signal name	Pin #	Signal name
21	P1[10]	22	P1[9]
23	P1[8]	24	P1[4]
25	P1[1]	26	P1[0]
27	USB_D-2	28	P0[31]
29	P0[28]	30	P0[27]
31	P0[26]	32	P0[25]
33	P0[20]	34	P0[19]
35	P0[13]	36	P0[12]
37	P0[11]	38	P0[10]
39	P0[1]	40	P0[0]

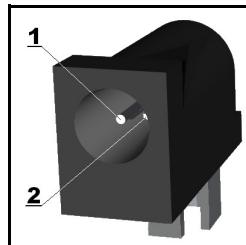
6.5 mini USB (device)

Pin #	Signal Name
1	+5V
2	D-
3	D+
4	Not connected
5	GND



6.6 PWR Jack

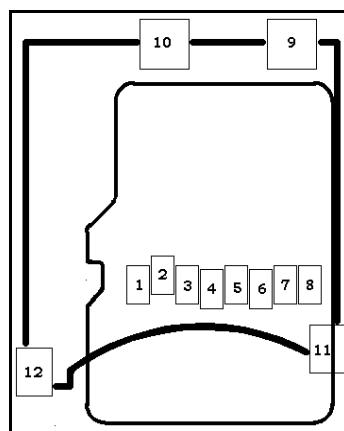
Pin #	Signal Name
1	Power Input
2	GND



6.7 micro SD/MMC slot

Note that the micro SD cards supported are up to 2GB of size.

Pin #	Signal Name
1	MCIDAT2
2	MCIDAT3
3	MCICMD
4	VDD
5	MCICLK
6	VSS
7	MCIDAT0
8	MCIDAT1



6.8 Jumper description

Most of the jumper configurations are printed with white print on the PCB for your convenience. This board has only SMT jumpers which require soldering/unsoldering.



VDDA_E

When closed supplies power to the external memory.

Default state is closed.



3.3V_UEXT_E

When open enables UEXT connector.

Default state is open.



3.3V_E

When open disables the power supply to the processor.

Default state is closed.



VREF_E

When open disconnects VREF on the processor (PIN24)

Default state is closed.

6.9 Touchscreen display with backlight

Anti-glare surface treatment

Pixels: $480 \times 3(\text{RGB}) \times 272$ Pixels,

Dot pitch: $0.066(\text{W}) \times 0.198(\text{H})$ mm

More info: http://www.datamate-j.com/201202/GFT043HA480272Y_Rev.A.pdf

6.10 Additional hardware components

The components below are mounted on MOD-LCD4.3 but are not discussed above. They are listed here for completeness:

Accelerometer

Additional SDRAM

Buttons BUT + RST

2 status LEDs + PWR LED

CHAPTER 7

MEMORY

7. Introduction to the chapter

On the next page you can find a memory map for this family of processors. It is strongly recommended to refer to the original datasheet released by NXP for one of higher quality.

7.1 Block diagram

As shown in the processor's documentation

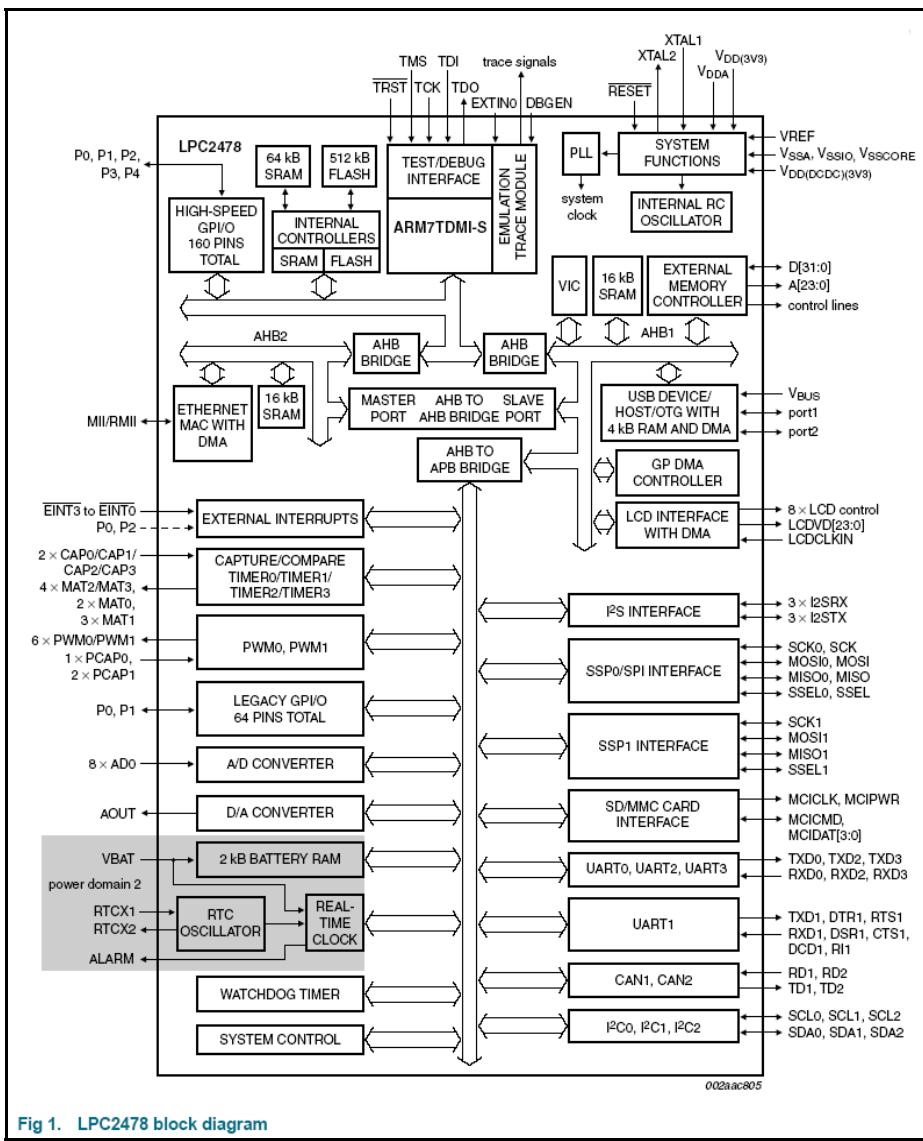
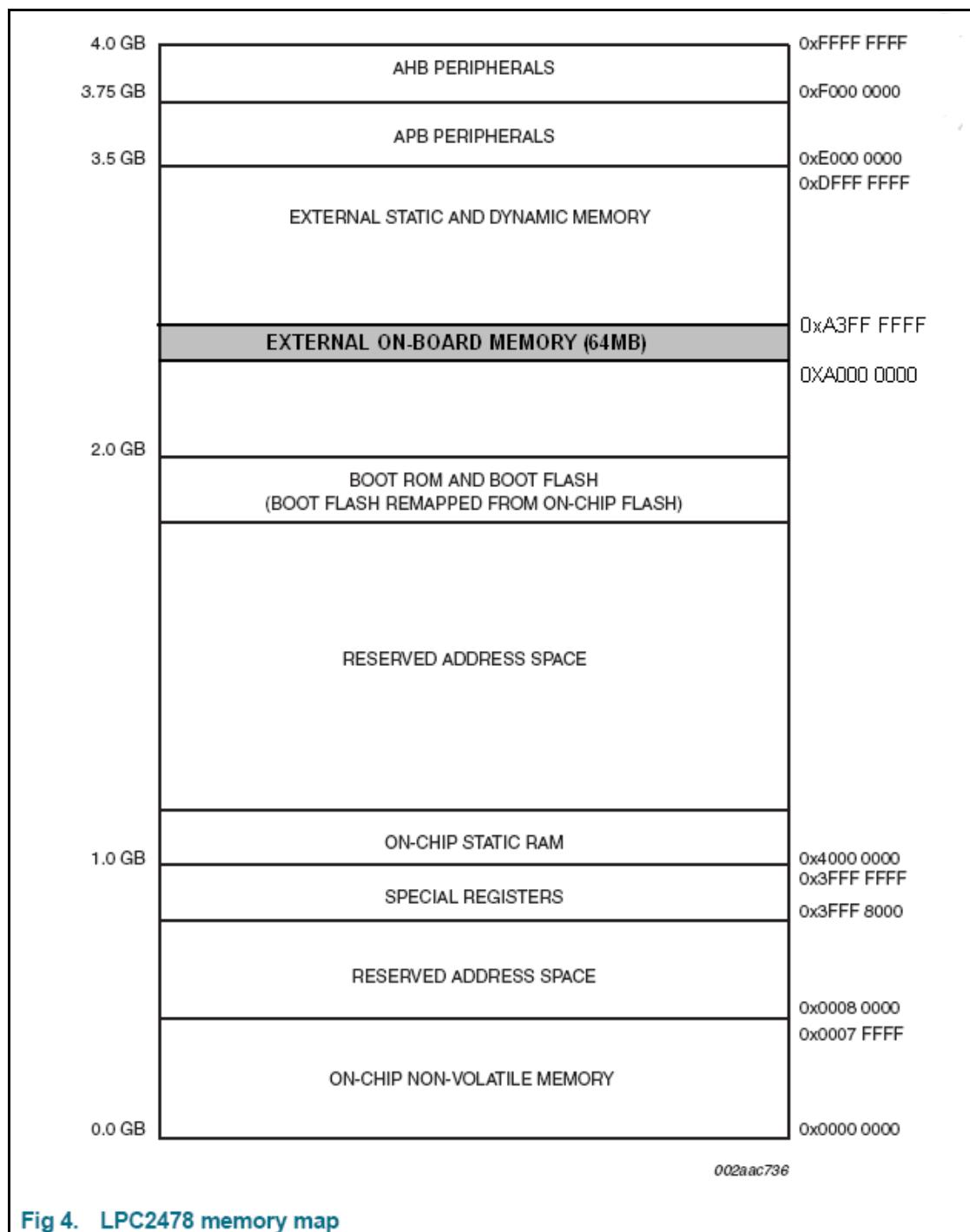


Fig 1. LPC2478 block diagram

7.2 Memory map



CHAPTER 8

SCHEMATICS

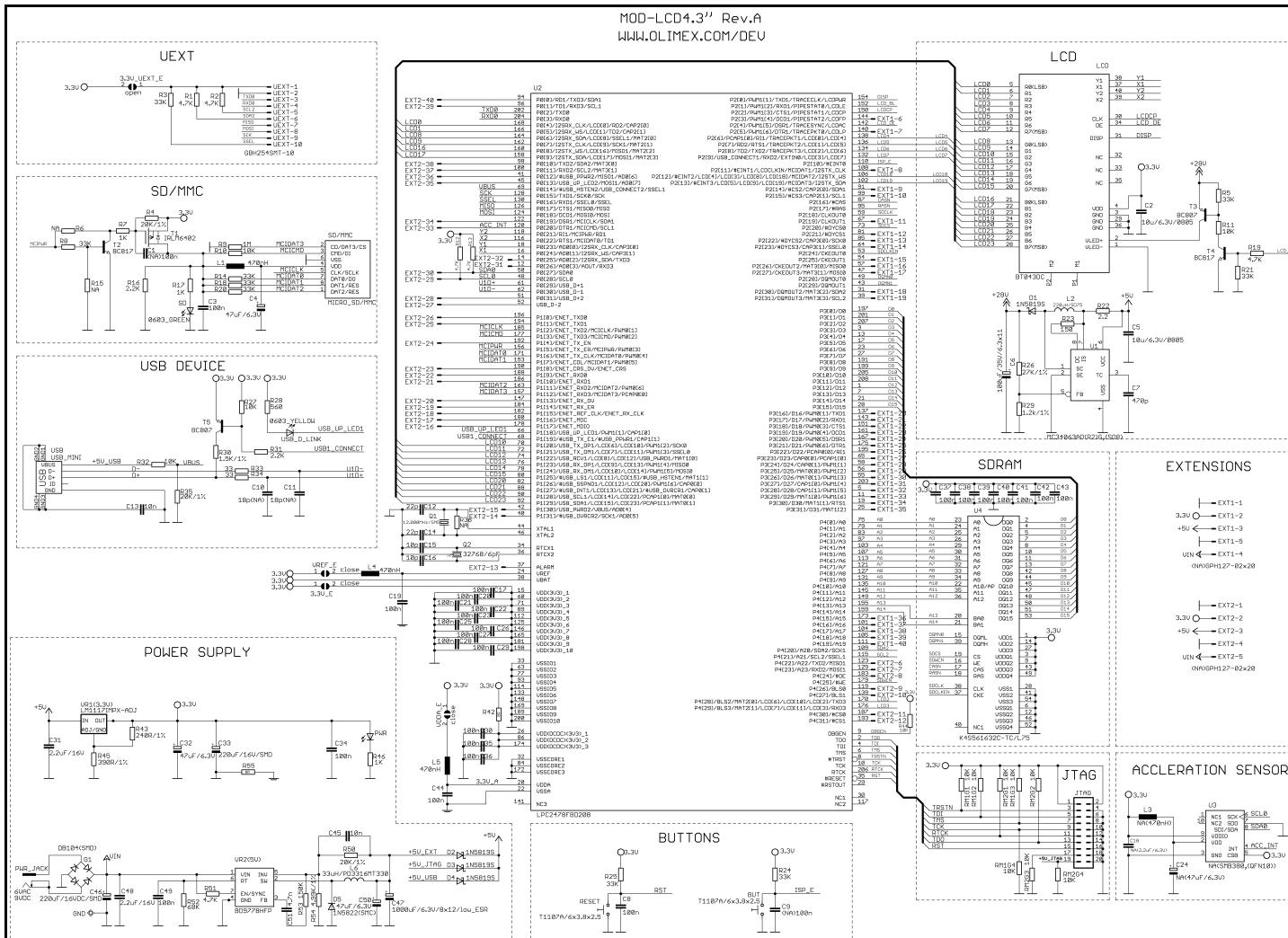
8. Introduction to the chapter

In this chapter are located the schematics describing logically and physically MOD-LCD4.3.

8.1 Eagle schematic

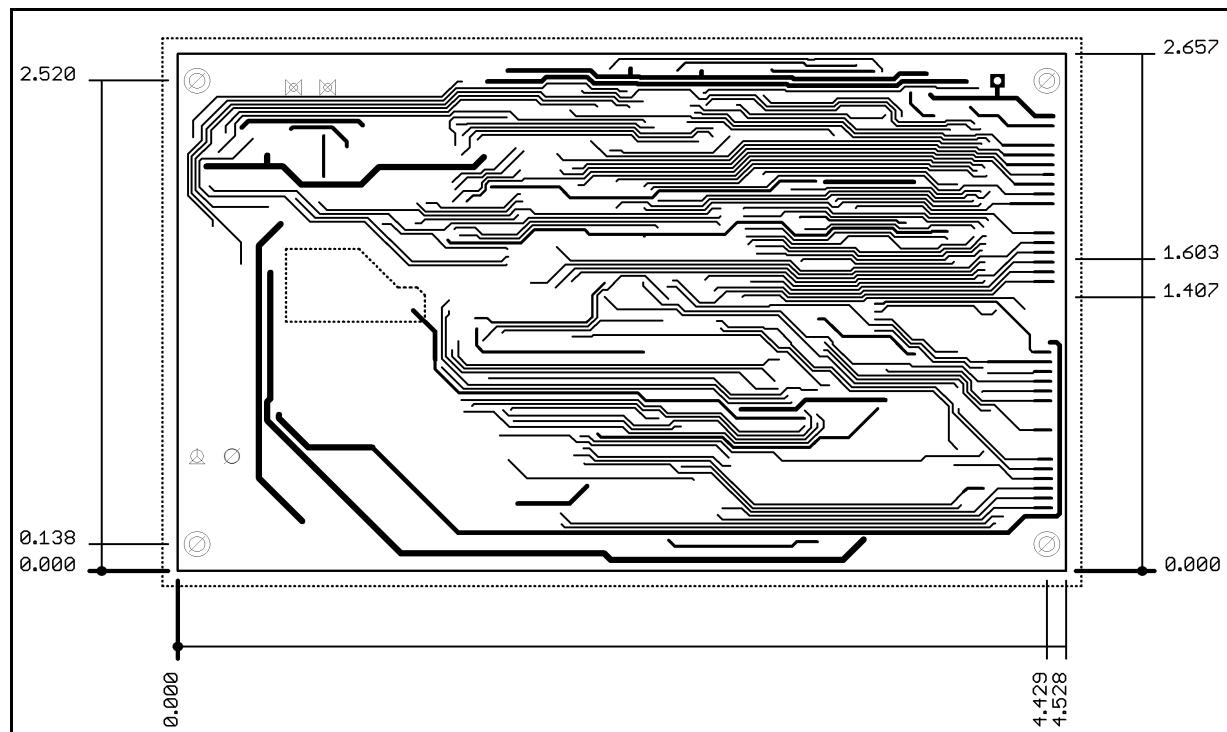
MOD-LCD4.3 schematic is visible for reference here. You can also find them on the web page for MOD-LCD4.3 at our site: <http://olimex.com/dev/mod-lcd43.html>. They are located in HARDWARE section.

The EAGLE schematic is situated on the next page for quicker reference.



8.2 Physical dimensions

Note that all dimensions are in inches.



CHAPTER 9

REVISION HISTORY

9. Introduction to the chapter

In this chapter you will find the current and the previous version of the document you are reading. Also the web-page for your device is listed. Be sure to check it after a purchase for the latest available updates and examples.

9.1 Document revision

Revision	Changes	Modified Pages
A	Initial Creation	All

9.2 Web page of your device

The web page you can visit for more info on your device is <http://olimex.com/dev/mod-lcd43.html>. There you can find more info and some examples.

ORDER CODES:

MOD-LCD4.3 - completely assembled and tested

ARM-USB-TINY - for custom programming/debugging

ARM-USB-TINY-H - for custom programming/debugging

USB-MINI-CABLE - USBmini to USB-A cable

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You can order to us directly or by any of our distributors.

Check our webpage <http://www.olimex.com/> for more info.